


**4104-913053-00**  
**Date: 10/04/2004**

**Beamline Equipment Protection (BE-EPS)**  
**Interface Control Document**  
**for the**  
**Generation-3**  
**Personnel Safety System**  
**(PSS)**  
**of the**  
**Advanced Photon Source**  
**at**  
**Argonne National Laboratory**  
**9700 Cass Avenue**  
**Argonne, Illinois 60439**

**WBS X.1.4.1.4**

	<b>ARGONNE NATIONAL LABORATORY</b>		<b>Document No. 4104-913053</b>		
	<b>Title: Beamline Equipment Protection (BE-EPS) Interface Control Document</b>		<b>Rev. 00</b>	<b>Approved</b>	<b>Date 10/04/2004</b>
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Prepared By:

\_\_\_\_\_  
R. Emerson,  
PSS Generation-3 Project Manager, ASD/SI

\_\_\_\_\_  
Date

Reviewed By:

\_\_\_\_\_  
Nick Friedman,  
PSS System Engineer, ASD/SI

\_\_\_\_\_  
Date

\_\_\_\_\_  
J. Servino,  
Consultant, ASD/SI

\_\_\_\_\_  
Date

\_\_\_\_\_  
M. Fagan,  
Consultant, ASD/SI


\_\_\_\_\_  
Date

Approved By:

\_\_\_\_\_  
Greg Markovich,  
Safety Interlocks Group Leader


\_\_\_\_\_  
Date



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## 1. DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

The following are some of the frequently appearing or unique acronyms used in this document. This list is provided as a quick reference for the reader's convenience.

ACIS Access Control Interlock System  
 APS Advanced Photon Source  
 ASD Accelerator Systems Division  
 BLEPS Beam Line Equipment Protection System  
 CPU Central Processing Unit  
 C&C Command and Control  
 DIW De-Ionized Water  
 DOE Department Of Energy  
 EPICS Experimental Physics and Industrial Control System  
 EPS Equipment Protection System  
 ES&H Environment, Safety & Health Manual  
 ESD Emergency Shut Down  
 FEEPS Front End Equipment Protection System  
 FOE First Optics Enclosure  
 I/O Input Output  
 IOC Input Output Controller (data collection for EPICS)  
 LAN Local Area Network  
 OI Operator Interface  
 PSS Personnel Safety System  
 PLC(s) Programmable Logic Controller  
 SAD Safety Assessment Document  
 SDD Software Design Document  
 SyRS System Requirements Specification  
 TBD To Be Defined/Decided  
 VME Versa Module Euro card  
 XFD Experimental Facilities Division

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## 2. REFERENCES

### Government Documents

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

Department of Energy (DOE) ORDER 420.2A, 01-08-01  
Accelerator Safety Implementation Guide for DOE O 420.2A, Draft, August 2001  
DOE ORDER 5480.25, 11-3-92  
DOE GUIDANCE 5480.25, September 1, 1993

DOE ORDER and GUIDANCE 5480.25 are included because they were in effect and referenced when the Safety Assessment Document (SAD) was originally written; it has been superseded by DOE ORDER 420.2, which has been superseded by DOE ORDER 420.2A. DOE ORDER 420.2(A) essentially made the approved SAD the effective regulatory document.

Copies of specifications, standards, drawings and publications required by suppliers in connection with specified procurement functions should be obtained from the contracting agency or as directed by the contracting office.

### Non-Government Documents

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

Environment Safety & Health Manual, Section 5.16 (ES&H 5.16) April 25, 2003, Argonne National Laboratory.  
APS Safety Assessment Document (SAD), Rev 1, May 1999, Argonne National Laboratory, Argonne, IL.

Compliance with the following required by SAD:

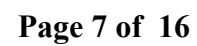
Stanford Linear Accelerator Center Report 327 (SLAC 327), April 1988, Stanford Linear Accelerator Center, Menlo Park, CA.


National Council on Radiation Protection Report No. 88 (NCRP 88), Issued 30 December 1986, National Council on Radiation Protection.

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal Agencies.

Document No. 1111-00001-00 APS Quality Assurance Plan, dated May 1990.


E000P-957085\_Install\_CheckOut\_Val\_PSS\_BLEPS-xx.doc. Installation, Checkout, and Validation of the PSS-USER BLEPS System

[illegible]

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## 2.2 NOTES & EXCEPTIONS

All Input Signals are High True unless otherwise noted.

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### 3. INTRODUCTION

#### 3.1 PURPOSE

This document defines the interface between the Users Beamline Equipment Protection System (BL-EPS) and the Advanced Photon Source Personnel Safety System (PSS). The primary responsibility of the User's BL-EPS is to ensure that the users Beamline components are protected from damage by synchrotron radiation.


#### 3.2 SCOPE

This is a mandatory interface required by the PSS for each shutter the User desires to operate.

The PSS to BL-EPS interface allows the User to provide the PSS integral shutter PERMITS, and the PSS to provide integral shutter status to the users systems. The PSS will make available beamline MODE STATUS if a mode shutter is present. Integral shutters are defined as beamline shutters, downstream of the front end (PS1, PS2, SS1, SS2) shutters. The integral shutter identification is provided by the XFD design group. Example; P5, P7, P8. The SI group shutter identification for these shutters adds a suffix identifying the first or only station the shutter protects. Example; P5B, P7C, P8D. In the example, the P5 Shutter protects the B station, the P7 Shutter protects the C station, and the P8 Shutter protects the D station. **The Beamline User must contact the SI group to determine which STATUS or PERMIT number corresponds to a specific integral shutter.**

#### 3.3 APPLICABILITY

This document applies to all of the Generation-3 beamlines.

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### 3.4 TYPE OF DOCUMENT

This document is a description of an interface provided to the beamline Users. The interface connections by the Users will be validated upon installation. For this reason PSS maintains a standard termination at the User end of the cable. This termination is provided on a WAGO connector. The responsibility of the User side connections lies with the beamline User. PSS personnel will provide technical assistance, explanations of relevant component parts and some assistance for testing this interface. PSS personnel are not responsible for and will not maintain the user side of this interface.

## 4. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein.

### 4.1 APS DOCUMENTS

Document No 1111-00001 APS Quality Assurance Plan, document dated May 1990.


### 4.2 DRAWINGS

Drawing No. 4104xxxx-212005 beamline dependent - PSS-to-BLEPS Interface Cabling Diagram.  
Drawing No. 4104xxxx-212006 beamline dependent – Mezzanine circuit board schematic.

### 4.3 PRECEDENCE

In the event of conflict between the provisions of the specification and other documents, the following precedence shall apply.


- This design specification.
- Documents referenced to the extent referenced herein.

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## 5. BACKGROUND FOR BLEPS.

The PSS System relies on input from User electronics for front end and integral shutter permits, and generates output to the User electronics for shutter status. Since these inputs and outputs affect the PSS system, it is essential that the User properly adapt to PSS wiring. There are two shutter interfaces between the PSS and the FE-EPS system and the User:

- Front End Equipment Protection System (FE-EPS). The Front End Equipment protection system has its own Interface Control Document describing the connections and functions between it and the User beamline system.
- Beam Line Equipment Protection System (BLEPS)—this document. This User-PSS interface is designed to allow the User to remotely provide a PERMIT for integral shutters to open, and to remotely receive STATUS open/closed of integral shutters and to receive MODE (mono or non-mono) information. BL-EPS exists to ensure that Beamline components are protected from damage or destruction by synchrotron radiation. A typical application would call for the User BL-EPS system to monitor the status of sensors for water flow, or vacuum pressure etc. These indications are summed (logical and) and provided as a BLEPS PERMIT for any integral shutter used to protect the area containing the sensors.

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## 6. OVERVIEW OF EQUIPMENT AND RESPONSIBILITIES

PSS-to-BL EPS or BL EPS-to-PSS signals for a beamline are as follows:

### 6.1 BL-EPS SHUTTER PERMITS

#### 6.1.1 Logic Levels

A logical 0 or false equates to 0 VDC. A logical 1 or true equates to +24 VDC.

#### 6.1.2 Description

For each shutter down stream from the Front End Shutter the Users Beam Line Equipment Protection System (BL-EPS) must supply a shutter permit to the PSS. When the permit for a shutter is true, the PSS will honor a request form the users HMI, control panel or Remote Shutter Interface to open the shutter providing all other required interlocks are true.

The only exception for all down stream shutters or integral shutters is the permit for a mode shutter. When the mode shutter is in white mode, the shutter is open to the non-monochromatic beam all of the time and the permit is not used by the PSS. However, when the mode shutter is in mono mode it is acting as a white beam stop (the PS and SS cylinders are mechanically locked) and the MS1 and MS1 cylinders will respond to the users HMI, control panel or Remote Shutter Interface to open the shutter providing all other required interlocks are true.

#### 6.1.3 Responsibility

The Users system must supply a BL-EPS shutter permit to the PSS for each shutter down stream from the Front End Shutter.


### 6.2 PSS SHUTTER CLOSED STATUS TO BL-EPS

#### 6.2.1 Logic Levels

A logical 0 or false equates to 0 VDC. A logical 1 or true equates to +24 VDC.

#### 6.2.2 Description

The PSS supplies a shutter status (open or closed) to the Users BL-EPS system for each integral shutter present on the beamline. This signal is true (+24VDC) only when the shutter is in the

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fully closed position. The PSS considers a shutter open any time it is not positively closed and the solenoids supplying air to the shutter are not being turned on by the PSS. The shutter closed status for a specific shutter will always indicate open (false) if the shutter is not installed in the beamline.

### 6.2.3 Responsibility

The PSS will provide the shutter closed status to the Users BL-EPS for each shutter in the beamline.

## 6.3 PSS MODE STATUS TO BL-EPS

### 6.3.1 Logic Levels


A logical 0 or false equates to 0 VDC. A logical 1 or true equates to +24 VDC.

### 6.3.2 Description

Mode shutters have two valid operating modes; mono and non-mono. This PSS mode status is used to enable a User to change shutter operating modes. The mode shutter status consists of two signals, mode status 1 and mode status 2. Mode status 1 is used to control mode changing. Mode status 2 is used to identify the shutter operating mode. Mode status 1 is set to true when a mode change is allowed and false to identify the shutter operating mode change is complete. Mode status 2 is set to true when the operating mode is mono and set to false when the shutter operating mode is non-mono. The Users BL-EPS system should only use the mode status (mode status 2) when mode status 1 is false.

### 6.3.3 Responsibility

The PSS mode status is provided to the Users BL-EPS by the PSS.

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## 7. INTERFACE CHARACTERISTICS

### 7.1 MECHANICAL INTERFACE – CABLE AND CONNECTORS.

The interface cable is terminated in the PSS station enclosure directly on the station circuit board. The interface cable is 12 conductor, 20 AWG. The interface cable is terminated at the User end by a standard WAGO 231-112/026–000 connector.

The cable is installed by PSS upon request from User. There are various WAGO connectors that can mate to the WAGO 231-112/026–000. Some are stocked by PSS and can be provided to the User.

### 7.2 ELECTRICAL/ELECTRONIC INTERFACE – PSS SIDE.


All interface signals shall utilize +24VDC voltage level. The electrical interface on the PSS station circuit board is shown (Fig 1).

All PSS to User BL-EPS signals shall be relay isolated: PSS PLC outputs drive relay coils. The contacts of these output relays connect the STATUS or MODE circuits to the User power supply.

### 7.3 ELECTRICAL/ELECTRONIC INTERFACE—USER SIDE.

All interface signals shall utilize +24VDC voltage level. The electrical interface on the PSS station circuit board is shown (Fig 1).

All User BL-EPS to PSS signals shall be relay isolated: User BL-EPS outputs drive relay coils. The contacts of these output relays connect the shutter PERMIT circuits to the PSS power supply.

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## **8. SAFETY CONSIDERATIONS**

### **8.1 VOLTAGE**

Low voltage (+24Vdc) circuitry is used.

### **8.2 FAIL-SAFE**

By using normally open (NO) relay contacts, the system is inherently fail-safe to faults such as loss of power or disconnected cables.


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Fig 1. The User WAGO Connector

The WAGO connector at the User end of the BLEPS interface cable. The SI group supplies these socket connectors. Typical mates to this connector include WAGO plug 231-612/019-000), which can be supplied to User by the SI group upon request. The interface cable is 12 conductor 20 AWG cable.

